THE BRITISH VETERINARY JOURNAL

EDITORS:
SIR THOMAS DALLING, *M.A., M.R.C.V.S., F.R.S.E.*
J. McCUNN, *M.R.C.V.S., L.R.C.P.*

Vol. 107 **July, 1951** **No. 7**

EDITORIAL

METHODS MAY CHANGE

THE wheel of life is always turning for all things in this world react to environment or prevailing circumstances and suffer change. Sometimes this change is sudden, even catastrophic, sometimes it is initiated by man's design and premeditated plan, other times the movement is so unobtrusive, so insidious, that it escapes the notice of all except those few who are at the centre of affairs and have eyes that see.

There is no escape from this natural law for change is inevitable, be it in nature or in man's affairs. The most we can do is to initiate a control so that the world may profit thereby.

Those who have lived through the first half of the present century have witnessed more changes than any of their forebears for in this short period of time the ways of life have undergone a complete revolution impelled by the advance in scientific knowledge and man's inventive genius.

The veterinary profession has not been exempt. There are few veterinary surgeons in practice to-day whose mode of life is not entirely different to that which they envisaged and which enthused them when they entered upon their chosen career. As regards their patients, they have seen the pendulum of importance swing from horse to dog and from dog to cow. They have seen the military and public health spheres of work rise to positions of supreme height and later decline almost to insignificance. Even the old typical odour of a veterinary surgeon's pharmacy has changed, for the pungent basic drugs of other days have given place to the tablet, the hypodermic syringe and the antibiotic.

The education of the undergraduates has been orientated from time to time to suit these new and varied circumstances.

(The June issue of The British Veterinary Journal was published on June 20, 1951.)

For over a hundred years this part of our life has been the responsibility of the Council of the R.C.V.S. and of the schools, and when one surveys their efforts it can be said that in spite of all their kaleidoscopic difficulties they have done their job well.

They have kept in mind the essential factor of any system of training, i.e., to produce a graduate reasonably competent to perform those multifarious duties which V.S.s encounter in their daily life and to render good service to their patients and the public. It has not been an easy task for the services demanded have been many and various and subject to change according to the circumstances, economic and otherwise, of the times.

If one asks, " How is it that such a difficult task has been done so well? " the answer must be that up to the present time the control has been in the hands of men fully conversant with the art and science of veterinary medicine and these men, with their finger on the pulse of general practice, have been able to orientate their thoughts and actions according to prevailing requirements.

Last year the composition of our ruling body was altered by Parliamentary decree. Now some of the places on that Council are filled by nominees and not by persons elected by the free vote of their peers.

It is not essential that those who hold their place by nomination shall be veterinary surgeons. Now this is a great revolution for it is possible that some of those who control our destiny and are called upon to assess the educational requirements of the profession may have no knowledge of the art and science or, indeed of the duties and responsibilities of a veterinary surgeon.

We live in a time when this system of appointment to position of control is quite a frequent occurrence in other spheres and there is abundant evidence that in some cases inefficiency and irreparable harm has been the result.

As regards the veterinary profession there may be further difficulties for the termination of the one portal system of entry and the substitution of a multi-portal method is bound to lead to variations in the quality of the course of instruction and in the competence of the graduate. One has only to turn to the sister profession of human medicine for factual evidence of this statement.

It may be that in some quarters the emphasis will be on the academic side, in others it may be the so-called practical aspect which is accentuated. Fortunately, the new authority does not start from scratch; it has the long experience of the R.C.V.S. to draw upon for guidance. The basis of the old system and the foundation of its success was that the course of instruction and the examination tests were designed to produce a graduate with a sound fundamental standard of academic knowledge and one who would be competent to perform those tasks which are the daily common lot of a practising veterinary surgeon. If these two factors are kept in mind the profession and the public need have no apprehension as to the future.

The words of the late Lord Dawson when addressing the Royal College of Physicians could serve as motto to our Alma Mater and to the profession. Their aim should be " The pursuit and encouragement of learning and service to the public."

XUM

SPECIAL ARTICLE

HISTORY OF VETERINARY PROFESSION 1851—1951—*(Continued)*.

C.—The Changing Face of Imminent Veterinary Problems Depending upon Periodic and Local Variations in the Domesticated Species of Animals both as regards (i) the Relative Importance of the Different Species and (ii) the Prevalence among them of Different Diseases

By J. T. EDWARDS, D.Sc., M.R.C.V.S.

(i) *"The farmer's animals have changed greatly both in appearance and purpose since Celtic times. Celtic horses were used for meat; sheep have ranged through milk, wool and mutton as their main purpose; oxen were valued for ploughing rather than for beef until quite recent times. The pig only, throughout the ages, has remained constant as a supplier of bacon, ham and pork."*—FRANKLIN, T. B. (1948). *A History of Agriculture.*

(ii) *"The most striking examples of rampant superstition and gross ignorance meet us at nearly every step in our investigation into the history of animal plagues; and one is puzzled whether to lay most blame on those who led ignorant people astray, or on the people who could be so credulous and short-sighted as to be guided and ruined by designing or infatuated men. . . . Laziness and priestcraft would rather believe in the vengeance of an Almighty power than in the troublesome causes which need active exertion and enlightened minds for their removal and prevention.*—FLEMING, G. (1871). *Animal Plagues,* Vol. I (Introduction).

I

SPEAKING at a meeting of the Liverpool Veterinary Medical Association held on August 9, 1867, John Gamgee ("the greatest genius the British veterinary profession has yet produced") said: ". . . We have suffered during the past quarter of a century from an *extraordinary epizootic influence.* Its origin was due to Sir Robert Peel and his advisers knowing nothing of veterinary medicine, and I blush to say that members of our profession for many years afterwards knew as little as Sir Robert Peel and his friends. The increase of our population and the advantages of free trade induced us to open our ports to foreign cattle. We have in times past suffered from foreign germs of disease, and no doubt some of the germs I am alluding to have never quitted the soil in the memory of man, but others have been banished by our forefathers, and were kept at bay by the withering influence of protection. . . ." (*Veterinarian, 40,* 754.)

To the recent veterinary graduate, well taught as he is to-day upon the manifold causes that are known now for certain to give rise to contagious and infectious disease, there is much in Gamgee's lyrical expostulation that may sound strangely naïve. Far from creating an impression of naïveté among the public to whom the words were spoken, they produced, on the contrary, either a feeling of incredulity or of open resentment.

XUM

Anyhow, in this present essay, it will be convenient to take the above passage as a text, as it were, for the theme we would wish to develop. That theme calls for elaboration under two main headings and it is our purpose to deal with the first of these in the present instalment.

We have already paid tribute, in our preceding two essays, to the enormous benefits which our profession in this country secured from Sir Robert Peel's great reforming ministry of 1841-1846; it was, as we have stressed, the fault of the profession itself that it did not secure still more abundant and more lasting benefits. Now, from the tone and tenor of Gamgee's statement, we are asked to believe that in a national respect in which the veterinary profession stood to prove its true worth some, at any rate, of the reforms put through at that time were, to say the least, not an unmixed blessing. Indeed, in some considerable measure they were destined to transform for the worse, during the succeeding century, the whole outlook of the veterinary profession. For nothing could avail the profession on reaching maturity to discharge the great tasks of national importance awaiting solution, at home and abroad, unless and until steps were taken by authority to ensure recruitment to its ranks of men well endowed with the requisite ability and inclination to master those tasks. In that respect authority in this country, as we have plainly stated already, signally failed.

II

We shall need, in the first place, to examine critically the known history of the subject we propose to deal with before the opening of the new era marked by the final triumph of the Industrial Revolution—which, as we have said, was signalised by the Great Exhibition of 1851.

Far too readily an older veterinary graduate (like the present writer), who had witnessed what he then believed to be a social order that was firmly established as it stood during the opening decade of the present century, would be tempted to conclude that, as never before, a violent and wholly unexpected transition took place shortly afterwards in the demands made for veterinary services, especially as concerned the species of domesticated animals claiming prior attention. Nothing could be more erroneous. That is to say, expressed more precisely, to imagine that the horse had been everywhere since time immemorial the dominant species in the human economy for which skilled attention was necessary would be false. To counteract such a mistaken impression immediately we have reproduced as superscription to this essay a short passage from a modern textbook on the history of agriculture wherein the place of the horse in the economy of these islands at no very distant past is stated. Perhaps the statement as it is made there is couched in much over-simplified terms; yet withal the language chosen is near enough to the truth to dispel at once any notion there must be in the minds of an older generation of veterinarians that they have witnessed in their lifetime the partial extinction of a once noble animal and its degradation to the sorry status in which it is now valued largely as so much mere carcase meat. In replacement, it has likewise been assumed, other species, cattle and other farmstock, and domestic pets have

gained an unprecedented ascendancy. It will repay to cast our minds somewhat more attentively at this moment towards the wealth of relevant evidence forthcoming in profusion from studies in new fields of inquiry. To our lasting profit, that exercise will enable us to shake off that illusion, and cause us, at any rate, to readjust ourselves all the more genially to the transformed situation.

Again, the last two decades have seen the rise of a mighty State organisation to resolve problems in connection with health and disease in the livestock of these islands. Perhaps too often it has been tacitly accepted that that organisation was brought into existence to clean up long arrears in a much-neglected situation that was essentially static. Nothing again could be more unwarranted than such a shallow appraisal: mighty achievements had been wrought in making these islands relatively safe for the selective breeding of our fine races of livestock long before the State was moved to embark upon the creation of expensive special departments to deal with the subject; and even before, it must be said with truth, systematic veterinary education was begun in the country. Worse than all, through that education, contrary to the intentions of its enlightened founders, taking, shortly after its inception — then having fallen into base and most unworthy hands — a distorted and atrophied course, the veterinary profession as it found itself at the opening of the century we have now under review was wholly unfitted to cope with the massive problems of the devastating plagues which invaded these islands soon after that opening. That was because of the freedom with which food animals could be introduced resulting from the action taken, as John Gamgee rightly stated, to secure from abroad a cheap supply of food, including animal food, which was to feed the fast-multiplying peoples of these islands then clamouring at all costs for cheap food, and taken too, regardless of the ill-effects of yielding to that clamour, as Benjamin Disraeli brilliantly forcasted at the time, upon our agricultural and livestock economy. We shall also need to elaborate in more detail this second proposition in our next instalment; for until we have done so, nothing will avail us in redeeming a current situation that is again in appearance static from lapsing into stagnancy, and subsequent, and consequent, decadence.

III

Those who have witnessed the changes in outlook of the veterinary profession since the first decade of the present century are left wondering, perhaps far more so than are recent graduates, what the *meaning* is of the transition that has taken place. Furthermore, having observed so much that has called for readjustment in outlook, they will again ask themselves almost certainly when it will be that that transition will end, and how much there is in the current situation that is destined to be merely ephemeral. A problem which at the beginning of the century appeared to have taken finite shape, based on the economic predominance of the horse, has, in other words, become transformed into a mainly dual one — namely, one that is, in large part, concerned with the milch cow as the supplier of what is *at the moment* regarded —and, *in this country,* with much good reason—as an essential food in the

XUM

shape of its milk for the people; and one too that is, in no less large part, concerned with the upkeep of luxury animals by a population showing an ever-increasing sentimental attachment to such animals.

A history of the period 1851-1951 cannot be written properly, we repeat, in the light of the socio-economic changes that have taken place within that period. Those changes have been immense. The historian of the future will probably declare that we have to retrace the story of the human race to a very distant past before we can find any corresponding period of profound changes. Writing recently, the distinguished authors* of a textbook declared, dealing with this topic: "The first great acceleration in material progress has been called the Neolithic Revolution, and it had unquestionably a deeper effect on the everyday life of men and women than any other episode in human history before the Industrial Revolution of the last centuries. And what an astounding acceleration it was! . . ." "Though man has inhabited the earth for more than half a million years," writes another prominent authority† within the same field of knowledge, "the invention of the steam engine, which introduced the machine age, occurred only one hundred and seventy years ago. Yet in this mere instant, as the life of the human race is counted, the machine has come to hold a place of such importance in the present-day American and European civilisation that it is not easy for us to imagine a machineless existence. . . ."

But, as we have said, it is not in the light of the socio-economic changes that have contributed to such great *material* progress that the finest achievements of the century under review must be adjudged. Rather, it is to the immense *cultural* changes that have so violently transformed our powers of understanding world events that we must accredit to the century a place already in history such as can hardly be assigned to any other period—so rich and varied have been our acquisitions in every field of knowledge wherein previously the human mind had to be content with mere allegory and myth. "Man's cultural changes have, indeed, been comparatively slow and have to be measured in hundreds and thousands of years, writes, in his introduction, another brilliant worker** within a corresponding field, "and in searching for the roots of the present-day cultures one invariably has to go back to prehistoric times. . . . Man is but too inclined to regard himself as the main figure on the earth's face. The real face of the earth is its landscape, determined by physiographical elements like elevation, relation to rivers, vegetation, animal life, and, dominating all, by the climate. It is the *environment* of man. He depends upon it in every respect, as regards food, clothing, housing; in short, the mode of life of a people is conditioned by its environment. Beyond this—it is almost commonplace to mention it—environment exerts an immense influence on man's mentality. . . ."

In truth, to obtain light upon the meaning of so much that is to record that is perplexing and paradoxical in the life of our own profession as it has been

* Hawkes, C., and Hawkes, J. (1949): "Prehistoric Britain." London: Chatto & Windus. (Also Penguin Book.)

† Herskovitz, M. J. (1940): "The Economic Life of Primitive Peoples." London: Knopf. Pp. 492.

** Zeuner, F. (1950): "Dating the Past: an Introduction to Geochronology." Second Edition. London: Methuen.

reshaping itself during the century under review we have had, perforce, to delve into the class of fresh evidence being produced in such rich profusion by workers of the kind we have now quoted. Soon after the date of the Great Exhibition of 1851, which marked the settled triumph in material progress of the Industrial Revolution, there broke upon the world an event which was destined, slowly but surely, to open the eyes of the human race at last to a sense of its own proper place within the scheme of things in the universe. That was the publication of Darwin's "Origin of Species" in 1859. The harvest of truth which has consequently been revealed now enables us to put man's own place somewhat as follows:—

Animals	Minimum period of existence* (in millions of years)
Man	1
Man-like apes	40
Lemurs	60
Placentalian mammals and marsupials ...	80
Mammals	160
Birds	140
Reptiles	250
Amphibia	270
Cockroaches and grasshoppers	215
Beetles	190
Caddis flies and moths	160
Winged insects	225
Wingless insects	275
Fishes	390
Worms	470
Lingulidæ and Brachiopoda	500
Total age of Earth	2,000 to 3,000

* Modified from Zeuner (1950), *op. cit.*

We need not dwell here on the merits of the evidence upon which the above figures are based, which, the reader may be well assured, would not have been reproduced if we had not taken pains to ensure that it was in the highest degree trustworthy. "I am confident," concludes the authority from whom the figures were taken, "that, ultimately, absolute chronology will attain the same significance in evolutionary research as now have dates and calendars in the study of human history. . . ." Needless to say, when that is achieved, those who have to minister to the needs of animals other than man need not suffer, as they were made to suffer in the past, from the notion prevailing universally except among an enlightened few that man was a "lord of creation" and that none except such as ministered to his needs and preservation on this earth was worthy of respect.

Furthermore, in the light of the profusion of new knowledge, the task must not be shirked of searching out whether there is to be found within it already enough to give us a better understanding of the many questions that ought, naturally, to claim the attention of the veterinarian above all else—

namely, those questions that concern the relations between man himself and other animal life in his *environment*. Hitherto, for example, the notion has prevailed that man brought certain species of animals under domestication to exploit them economically; that is not true—or, at most, only in part true. After careful scrutiny of the evidence, another competent authority* writes, in this respect: "The conclusion is thus inevitable that the peculiar symbiosis under discussion was not entirely effected through deliberate human aiming at exploitation of beasts, but was due to a variety of reasons still powerful alike in tribes lacking all domestic beasts and among peoples well versed in animal husbandry. But though practical considerations are not primary, they often assert themselves and exert a potent influence on primitive economics, sometimes in ways no longer familiar to us. . . ."

IV

It has been quoted above, with much sound reason, that nothing comparable with what happened a century ago, and of which the Great Exhibition was the outward symbol, had happened since the Neolithic Revolution. That was a short period of about a thousand years only when the human race over a large part of the world, beginning in the Near East and Middle East, showed great energy, settled down to live in large communities, and began agriculture and the domestication of livestock. Nothing comparable in importance had happened during the preceding half a million and more years of man's existence.

But again to understand the meaning of that first great awakening, we must not rest content until we have traced the full story of humanity before that happening. The race had not been slumbering. Indeed, it was during this long earlier period in its history—the Palæolithic Period of the archæologist—that in the face of the several changes in climate which the earth then underwent, namely, during the Ice Age—the Pleistocene Period of the geologist, and a relatively very short one to him—that man was soon to emerge supreme, after many vicissitudes, endowed, as it proved, as none of his fellow beasts were endowed, to exercise dominion over the earth, and soon to bring those among them of his choice under domestication for his purposes.

All along the evidence that this was the truth had been awaiting, as it were, to be disclosed at our very doorstep. But, for a reason that is deep-seated in the emotional make-up of humanity, the truth had been obscured throughout the centuries, before the coming of the century under review, by that blend of magic, superstition, and myth which the anthropologist finds is common to all peoples before full awakening.†

* Lowie, R. H., in Boas, F. (1939): "General Anthropology" (article on "Subsistence," pp. 282-326). Boston: D. C. Heath & Co.

† See Benedict, R., in Boas's (1938) "General Anthropology": "There is a fundamental difficulty in the problem of religion that is not present in the study of other cultural traits. All other social institutions rise from known bases in animal life, and our problem is to relate them to their point of departure among the natural endowments and note the very different forms they have assumed among different peoples. . . . With religion this is not true. We cannot see the basis of religion in animal life, and it is by no means obvious upon which of the specifically human endowments it is built up. . . ."

To illustrate man's relations with other animals during the long period that was to elapse before he established that complete mastery over them which found expression in what has now been referred to as the Neolithic Revolution, we will choose but one example out of the great wealth of material evidence now on record.

It will be convenient, before we submit our illustration, if we compare man's evolution with that of the horse, upon which the testimony of fossil remains is far more abundant and which goes back to cover a period reckoned to be just about eighty times as long as that of man.

In Table I, an attempt has therefore been made to correlate on a time-scale the evolution of horse and man, in relation to all animal species in general.

The researches of the last thirty years have shown that the Ice Age was not one continuous period of arctic climate, but that during the 600,000 years it lasted there were well-marked breaks, which can now be timed for a given geographical area with considerable precision. At its most intense phase the Polar Cap did not extend farther southwards than about the latitude of the Thames, but there were long intervals of northward recession. At the same time there were correlated changes in the sea level, a complete break with the Continent not occurring till about 7,000 years ago, so that until then there had been no hindrance to the exchange of faunal species between Britain and the rest of the world. Briefly, during the period there were four major glaciations, separated by three interglacials, the longest of these being the middle, or penultimate, interglacial, which covered 190,000 years, while the last and the ante-penultimate interglacials each covered 60,000 years. Neither was each major glaciation a period of continuous low summer temperatures; each was again interrupted by stages when the climate assumed a cool-temperate character, but not the continental character of the typical long interglacials. Thus, the last glaciation was interrupted by two such cool-temperate stages, and each of the earlier three by one stage. There were corresponding fluctuations in the fauna and the vegetation. The duration of the successive phases and stages has now been well estimated from calculations of the intensity of solar radiation throughout the period.

The illustration (Table II) given is not to be taken as representative of the changes actually undergone in other regions, but for our immediate purpose—which is of depicting the great fluctuations in the animal population of these islands during a not very long period of their history—it will probably suffice.

The table calls for a few explanatory remarks. The three phases of the last glaciation varied somewhat in intensity, the last being a good deal less intense than the first two. Hence, at successive depths in the cave earth, the first two phases are marked by well-defined slab layers, consisting of masses of rock fallen from the roof and sides of the cave, washed afterwards free of loose earth. Stone tools indicative of human life were not found in these slab layers, but skeletal remains of an arctic fauna were discovered in each. In the last of the three phases, the climatic conditions, however, were such as to produce a long period of wet and cold, without marked glaciation, and this, in

XUM

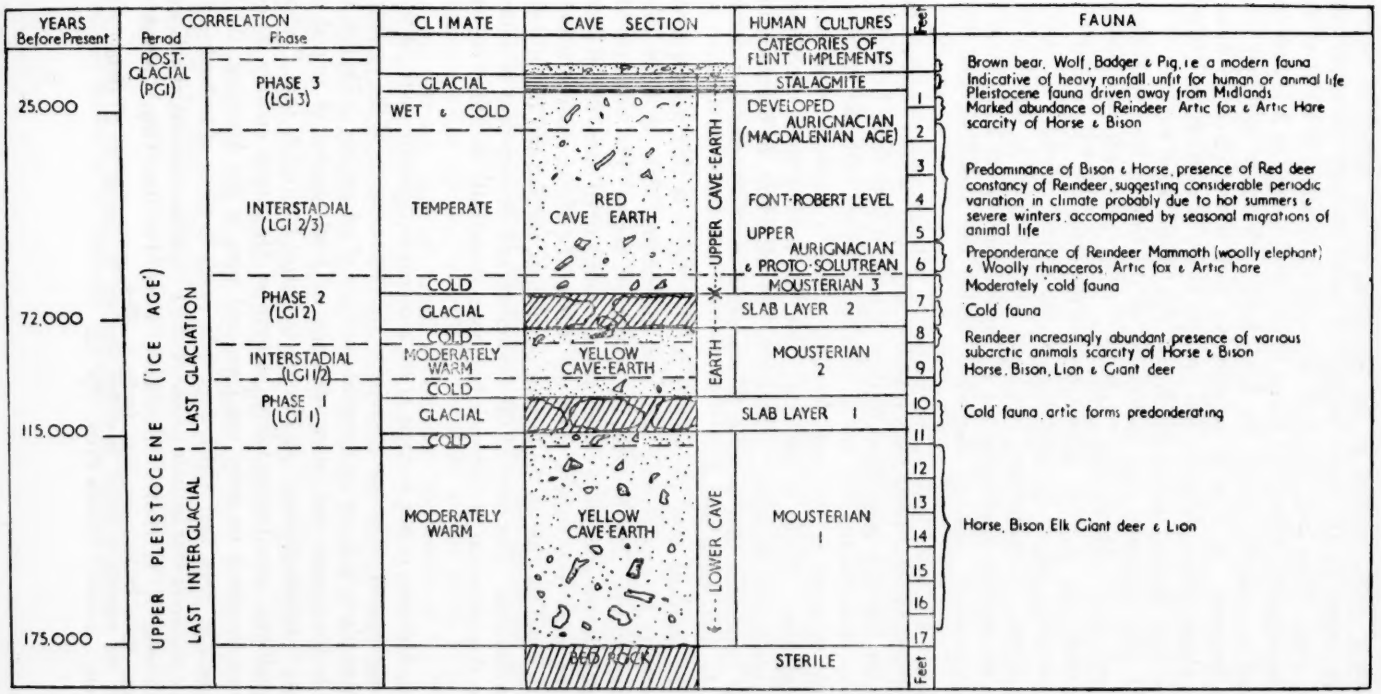
TABLE I

(NOT to scale) Illustrating successive appearance and dominion on earth of the several Classes of Animals, with special reference to Horse and Man. (modified after Zeuner 1950)

ERA	YEARS (Before Present)	GEOLOGICAL PERIODS and EPOCHS		FAUNA	HORSE (Fossil Species)	RELATIVE INTERVALS (As estimated by morphological differences)	MAN
CAINOZOIC	10,000	QUATERARY	HOLOCENE				
			PLEISTOCENE(Ice Age)	No new genera	Equus capallus	1	Homoneanderthalensis, Homosapiens.
	1M				Equus scotti		Early Man: Pithecanthropus, Sinanthropus, Eoanthropus, Heidelberg Man.
		TERTIARY	PLIOCENE	Increasingly modern reign of placental mammals, birds, insects teleost fishes &c.	Hipparion	7	
			MIOCENE		Merychippus	11	
	30M				Parahippus	18	
			OLIGOCENE	First monkeys and apes	Miohippus	5	
					Mesohippus	5	
			EOCENE	Mammals increase and become dominant; placentalia appear - carnivors, rodents, elephants &c. First lemurs.	Epihippus	16	
					Orohippus	9	
	58M		PALEOCENE		Eohippus	9	
MESOZOIC		CRETACEOUS		Majority of large reptiles die out			
	127M			First Birds			
		JURASSIC		Reign of Large Reptiles - Ichthyosaurs. Dinosaurs. Pterosaurs. (flying reptiles)			
	152M			First non-placental mammals			
		TRIASSIC					
	182M						
PALAEZOIC		PERMIAN		Early forms of animal life appear, in succession - starfishes, snails, scorpions, fishes, amphibia, spiders, insects.			
	203M	CARBONIFEROUS					
	255M	DEVONIAN					
	313M	SILURIAN					
	350M	ORDOVICIAN					
	430M	CAMBRIAN					
	500M						

XUM

TABLE II



Section of Pin Hole Cave, Creswell Crags, Derbyshire, according to Armstrong (1931) modified after Zeuner (1950)

Armstrong's* view, resulted in the formation of the stalagmite layer which would be caused by the heavy seepage of water through the earth overlying the cave roof. That long period of unpropitious weather, in his view, resulted in the characteristic Pleistocene fauna eventually leaving the Midlands area, to give place to a modern fauna, the horse being now absent while pig and wolf became frequent. It is to be remembered that several thousand more years were to elapse before the horse was brought under domestication, when it was imported from Europe during the Bronze Age, about 2000 B.C.

The flint industries give indications of the human types prevailing, the rough tools of the Mousterian "cultures" being associated entirely with the more brutish type of man—*Homo neanderthalensis,* the "cave-man" type—which prevailed before the evolution of the more "refined," or intellectual-looking, types ("Cro-Magnan," etc.) and which blended in different localities to form the peoples constituting the *H. sapiens* races as we know them to-day, which increasingly asserted themselves during the Mesolithic and Neolithic periods.

However much, in any case, a present-day observer may recollect fluctuations in the livestock population of these islands, it is evident, from the above figure that those fluctuations are as nothing compared with the immense ones that have occurred in the same localities within a relatively short period of geological time. While, at the same time, the human types prevailing have likewise undergone immense "refinement," on the whole, in breeding, to cope with the conditions that were to favour rapid multiplication and dominance during the post-glacial period.

What followed after the end of the Ice Age was that the lands nearest the retreating ice-cap became wet and tree-ridden, while in more southerly zones they became, little by little, desiccated and desert. The withering of their food supply forced animals to cluster around the scattered oases, and in particular within the great river valleys, from the Nile to the Indus, each of which then saw, with rapid increase in the human population, the rise and fall of successive great civilisations. The story of the beginnings and development of agriculture and the domestication of livestock has been abundantly recorded elsewhere.†

V

It is, however, to our purpose at the moment to delineate more particularly certain phenomena which are apposite to the circumstances of the present time. In the first place, it is not an essential attribute of advancing civilisation that it has led to the greater and better utilisation of food supplies of animal origin. There are "untold millions," as Herskovitz (1940) has rightly said, "whom we call 'primitives,' who to-day follow patterns of life almost entirely dissociated from those by which we order our lives, and who, in the Americas, the South Seas, Australia, Asia, and Africa meet their needs in terms of technological and economic resources that include no use of those complex mechanical aids we hold

* Armstrong, A. L. (1931): "Excavations in the Pin Hole Cave, Creswell Crags, Derbyshire," *Proc. Prehist. Soc. East Anglia, 6,* 330-4.

† See, for example, a useful, up-to-date summary in Curwen, E. C. (1946): "Plough and Pasture." London: Cobbett Press. Pp. 122.

XUM

so essential." One such example, which will probably make readers who suffer from our restricted rationing really envious, may be cited from the dietary of a people whom we would otherwise be tempted to class as among the most backward, namely, the Indians of the Guianas. According to Roth,* these peoples obtain from the forests in which they live the following animals: the agouti, the armadillo, the bush hog, the deer, the manati, monkey, otter, rat, sloth, tapir, and water haas; of birds they trap quail, duck, toucan, and guacharo; they have thirteen different methods of catching the fish that live in the rivers, while from these streams they also gather turtles, iguana, alligators—whose flesh and eggs are both consumed—frogs, crabs, and molluscs. Toads and snakes offer another resource, as do earthworms, beetles, ants, and wasps and bees. Vegetable foods are mainly supplied by agriculture, which yields cassava, maize, rice, and some twenty-four "economic plants." But there are a number of "cassava substitutes" collected from natural sources—mora seeds, greenheart seeds, dakambali seeds, pario seeds, and nuts of the swari tree, besides the twenty-seven kinds of "wild fruits, berries, nuts, etc.," that have been listed. In addition to all the foregoing, the Indians draw on their forested home for the materials they employ in making their fermented drinks and, besides tobacco, which they grow, for the four other types of narcotics and stimulants they enjoy.

Neither is the practice of selective breeding unknown to the primitives. For example, quoting Bogoras (1904),† Herskovitz mentions the Chuckchee of Siberia who depend almost entirely on their herds of reindeer for their subsistence. Chuckchee herdsmen carefully select, for breeding purposes, does of hereditary lines known to produce the strongest fawns. The herd is shrewdly evaluated from this point of view, the herdsman noting the lineage of each of his animals over three or four generations, and determining which does are least desirable from his knowledge of the kind of deer each lineage characteristically produces. When the need for meat arises, he selects those females least likely to produce the best fawns; while, on the other hand, in breeding he so arranges the mating of his animals that his herd eventually consists of the most desirable type.

Again, quoting Speck (1914-15),** the same author refers to a custom among the Ojibway tribe of American Indians: the words of an old chief show how this people were alive to the benefits to be derived from calculated conservation of resources. "Wherever they went the Indians took care of the game animals, especially the beaver. . . . So these families of hunters would never think of damaging the abundance or the source of supply of the game because that had come to them from their fathers and grandfathers and those behind them. . . . We Indian families used to hunt in a certain section for beaver. We would only kill the small beaver and leave the old ones to keep

* Roth, W. E. (1924): "An Introductory Study of the Arts, Crafts, and Customs of the Guiana Indians," *38th Ann. Rep., Bur. of Amer. Ethnol.* (cit. Herskovitz).

† Bogoras, W. (1904): "The Chuckchee, Material Culture," *Publ. Jessup N. Pac. Exped.*, *7* (1).

** Speck, F. G. (1914-15): "Basis of American Indian Ownership of the Land," *Old Penn.* (Weekly Review of the University of Pennsylvania), pp. 181-96.

XUM

breeding. Then when they got too old, they, too, would be killed, just as the farmer kills his pigs, preserving his stock for his supply of young."

"The brief history of these ('primitive') peoples," says the above authority, "in contact with those who write of them has given us quite sufficient grounds for holding that as regards willingness to accept inner change and outer borrowings they are no different from other peoples." In the light of what has been summarised in the preceding section, one can now perceive no reason why they should be different; for the whole story of mankind is a phenomenally short one.

Concluding his penetrating analysis of the factors governing evolution in the light of the accumulated quantitative data now forthcoming, Zeuner (1950)* stresses four points of cardinal importance:—

(1) There appears to be a fastest rate of evolution of the animal kingdom under natural conditions, namely, about 500,000 years per species-step;

(2) In evolution the number of generations appears to be less significant than absolute time;

(3) Every species passes through an episode of rapid evolution but may become stabilised thereafter and persist unaltered for a very long time; and

(4) Every higher category also passes through an episode of intense evolution, which lasts for something like 50,000,000 years.

The combination of points (3) and (4) leads, the same author remarks, to an interesting conclusion: if genera pass through a period of abundant species formation, lasting about 50,000,000 years, and if each species needs about 500,000 to 1,000,000 years to evolve, the number of successive species-steps in a lineage is limited to something of the order of 100 during the explosive episode of the genus, after which the rate slows down.

One can hardly over-stress the possibilities that are now open to us for the better understanding of all kinds of biological processes from conclusions such as the above which have been formulated on the best quantitative evidence available and which are the outcome of the great cultural advance made during the century under review. For one thing, they explain satisfactorily why no new species have arisen during the post-glacial period, covering the last 10,000 years. For another thing, they may explain perhaps why the human capacity for expressing its inner self in art forms, as exhibited in the cave drawings of animals made by early Palæolithic man discovered in the South of France and Northern Spain, which are remarkable for their purity of line and design, has made no astonishing progress to the present day. But there are many other problems that now call to be looked at afresh in the light of an understanding of the processes of evolution, the conception of which even had not entered into men's minds at the beginning of the century under review.

VI

The revulsion against natural breeding habits in captivity, it has been well said,† is the chief barrier against multiplication of domesticated species.

* Zeuner, F. (1950), *loc. cit.*, pp. 385 *et sqq.*

† See Lowie, *loc. cit.*

For at least two thousand years no species of economic value has been brought under domestication, and our main livestock animals have been living in symbiotic partnership with man for more than five thousand years. The original mutual attraction has varied greatly in the case of the different species: in the case of the dog, it seems that it was the pull of the warmth from human fireplaces; in the case of the reindeer, the frenzied urge to partake of human urine. The obvious explanation, namely, that of initial deliberate economic exploitation, will not withstand careful inquiry. As Hahn long ago stressed, irrationality has nearly always played a part in incipient domestication: ". . . Wild sheep have no wool; wild cows yield milk adequate only for their calves; wild fowl lay only a modicum of eggs. It is a commonplace of the history of culture that the Chinese have kept cattle for millenniums, yet never milk cows or females of other species of livestock. These same people are likewise sheep-breeders of long standing, yet have never made woollen textiles. In Burma and its vicinity—the probable centre of ancient chicken-raising—poultry are not primarily kept for utilitarian purposes, and the eggs are hardly, if ever, consumed." What the natives, it is said, mainly want is to use the thighbones of the cock for divination: bamboo splinters are thrust into the foramina and the future is divined from the various angles at which the splinters project. This practice is recorded by Chinese observers going back to 110 B.C. . . . The pig also figures as an animal used for divinatory purposes, its gall-bladder being examined by the Karen of Burma and the Khasi of Assam. Again, while swine appear as domesticated animals in prehistoric Egypt, not one practical purpose for their keeping has ever come to light: they were neither eaten nor worked in any way until a relatively late period.

Perhaps, Lowie here, in making this statement, was unaware of the significance of the practice persisting among "primitive," and indeed among "civilised," people even to the present day to accumulate livestock as a manifestation of non-pecuniary wealth. Thus, Herskovitz mentions as an illustration how on Malekula, in Melanesia, a wealthy person is described as one who possesses many boars with finely carved tusks, and one or many houses filled with yams. It is essential, to be respected as among the wealthy, that a man gives his attention to the acquisition and care of pigs. It is not, however, so much the number of his pigs as their quality that is of moment, especially as this relates to the more prized growth of the tusks of the boars. Again, after the introduction of horses into the Plains area of North America, horses furnished, among the non-pecuniary societies, almost the only index of wealth. In East Africa, where currency in any form is absent, cattle, as is well known, constitutes an exclusive hall-mark of wealth. "The subsistence economy of these tribes is based on agriculture; but the number of cattle owned by a man correlated highly with his position, for position here, as in most societies, is related to wealth, and cattle are the sole expression of wealth. . . . While the concepts of money and wealth are closely related, money is in no way indispensable to the existence of wealth, or to the existence of economic status as comprehended in the concept of a wealthy man." This conclusion, based on

XUM

anthropological studies, will not occasion surprise to anyone familiar during the last half-century with the vagaries in fortune of current veterinary practice in this country in which we ourselves now live.

We cannot dismiss this subject without reproducing some more relevant evidence. "Non-rationalistic motives," Lowie continues, "persist even in sophisticated civilisations that are well able to exploit some of their animal species. The reasons for the existence of lap-dogs, race-horses, and bulls for the *plaza de toros* are sentimental and sportive. The Chinese have kept crickets partly in appreciation of their music, partly to train them for the cricket arena." Though the horse is of little use to the Bedouin Arab—the camel being to him in his wholly contrasted climate an animal as indispensable as the reindeer is to the Lapp—he will take infinite care to raise a mare and disregard the comfort of his household on her behalf. "The whole camp may suffer from thirst, and the children cry for a drop of water, but the master, unmoved, will pour the last remnants of water into a dish and set it before the pampered mare."

What practical uses a people will put animals to when they are domesticated again becomes problematical. The idea of eating beef is often quite remote even from experienced cattle-breeders. "The Bantu as a rule eat only the flesh of cattle that have died of disease; slaughter is peculiar only to great festive occasions or looms as the prerogative of chiefs." "The Kirghiz of Turkestan ride oxen on domestic errands or harness them to plough in farming, but they will never eat beef if well-to-do, and even in destitute circumstances with the utmost reluctance." "For them, mutton is infinitely preferable, while the sheep-raising Baganda taboo it." Negro stock-breeders prepare no cheeses, "which seem to be a unique achievement of the pastoral nomads of Eurasia; and there are African tribes who churn butter only to smear it as a cosmetic over their bodies. . . ."

"Capricious irrationality" enters to an unsuspected degree in the breeding of domesticated stock, during all epochs, in all regions. "We expend thousands," says Lowie, "for breeding race-horses"—largely, be it said, the descendants of the Bedouin's "pampered mares"—"but have never taken up the milking of mares. Yet in Turkestan, 'people of means live almost exclusively on *koumiss*, consuming it in enormous quantities' during the summer-time; and Rubrik reports of his Mongols that so long as they had mare's milk they cared little for other food."

Most significant of all has been the history of the Chinese, as we have said, in relation to their attitude towards domesticated stock. Cut away at an early stage as that great civilisation was from easy intercourse with the contemporaneously emerging civilisations farther West, the uses which they made afterwards of the various species that had been already brought under domestication have differed greatly. Hence, though they have been familiar with cattle for thousands of years, they have never thought of milking their cows. In spite of coming afterwards in contact with nomads who did not scruple to take milk from all their females, the Chinese have retained unaltered the "cattle complex" that had been evolved before their separation and the invention of

dairying. "The ox was a beast for drawing the plough, and there its uses ceased." The pig became the prime food animal for the Chinese, and we have largely to thank them for the improvement of our own native breeds, which came through crossing Chinese strains with the coarse native types of these islands, during the 19th century.

VII

Now, in the first instalment of this series of articles, we opened up with the statement that the century under review ushered in what has been called the Golden Age of Agriculture. It was not until a generation later, when the virgin lands of North America yielded of their abundance in grain and the stockyards of the Middle West were replete with cattle raised on the prairies, ready for canning and export, that agriculture in this country had to face competition of the kind it could not withstand, and so experienced unparalleled disaster. "British farmers had to discover how they could hold their own, in a poorer climate and on highly rented land" (Franklin, 1948, *op. cit.*) "which needed continual manuring to keep it in good heart. . . . Now the splendid condition of the grassland on the best farms repaid all the trouble that had been spent on it, and the wise routine which had been the rule for many years paid good dividends in milk. . . . But neither the farmers nor their men liked cows; they tied the men to seven days' work a week, they made a dreadful mess of the farm buildings, and the cattlemen disliked the change from fattening cattle. As soon as the price of beef rose again they returned to bullocks with delight. . . ." The present writer can well recollect those prejudices.

Now, the question may well be asked, and it need only be a rhetoric one, whether the very recent recurrence on a far larger scale of the advocacy of milk is based mainly on its economic utility as an essential human food or whether that advocacy contains a large ingredient of "capricious irrationalism." Whether it is the one or the other, the present-day prosperity of veterinary practice represents a phase that is largely directly dependent on the hold which that advocacy has succeeded in gaining to establish milk consumption as a custom among our present population. The question then remains how long, in the interests of the veterinary profession, that phase will continue. After all, it is not derived from an ancient tradition as is the Chinese one of pork-eating, but it is essentially modern. The difference in attitude of the Scots and Irish towards pig-eating rests on a much longer tradition.

Whatever the proper reply to the above question is, of one thing we can be sure: that is, in just the same way as the virtual extinction of the horse for most economic purposes towards the second decade of the present century did not sound the death-knell, as was apprehended by many, of the veterinary profession, so a restriction of dairying practice need not necessarily diminish its prospects.

"Social phenomena," as Lowie (*loc. cit.*) says, "are not simple, and accordingly the same conditions, owing to an indefinite number of unknown concomitants, will produce quite different results in different areas. If wild cattle exist in a certain country it does not follow that the natives will domesti-

XUM

cate them. If they domesticate them, it does not follow that they will milk cows or eat beef. Religious or dietary preconceptions or sheer ignorance of utilitarian possibilities may play an incalculable part, checking or precluding economic utilisation."

Anyhow, the ground has been prepared, we hope, for a better exposition of the second, and correlated, theme in the title of this present essay. That second theme, in the past, has been looked upon but too often as the only one, and in a narrow sense too, that ought to engage the attention of the skilled veterinarian. We hope to be able to show that no worth-while achievement can ever be made by the veterinarian within his domain except by examining whatever major problem that comes before him for solution in its larger context. And there is no valid reason, we submit, why, in truth, he should not feel well qualified—and better qualified too than most men—to undertake that particular kind of effort.

As never before—and as is exemplified (we trust) in elucidating the theme of the present essay — the veterinarian, from the nature of his calling, now stands vindicated as not only a substantial contributor to the *material* welfare of humanity; but it is offered to him also (and in ways hardly suspected at the opening of the century under review) to become a potential protagonist in the colossal *cultural* advance which is the glory of our contemporary civilisation.

(To be continued)

STUDIES ON THE BLOOD OF DOGS

VI.—Hæmatological Findings in Some Diseases caused by Specific Blood Parasites: (a) Babesia canis; (b) Hepatozoon canis

By M. R. El HINDAWY, M.V.Sc.(Cairo)

Lecturer in Pathology, School of Veterinary Medicine; Fouad I University, Cairo, Egypt.

Babesiasis

Three cases of babesiasis were met with in this study. Serial blood examinations were carried out on them over a long period. One case was in the acute form and ended fatally; the remaining two cases showed chronic affections.

The acute case showed marked emaciation, anæmia, icterus, depression and loss of appetite; temperature rose up to 41.5° C. (106.6° F.). Skin disorder, conjunctivitis and catarrhal inflammation of the visible mucous membranes were other symptoms. The case ended fatally after paralysis of the hind limbs had set in.

In the chronic cases the symptoms were less pronounced; the anæmia was slight and the visible mucous membranes were of pale, yellowish colouration.

In the acute case (post-mortem), the liver was congested and the bile thick and of a dark colour. The spleen was enlarged to about twice the normal size; it exhibited a dark colour and had rounded edges. The kidneys were congested; small petechial hæmorrhages were noticed on the surfaces. The heart muscle was pale; small petechiæ and ecchymosis were observed on the epi- and endocardium. The lungs were œdematous; ecchymosis occurred under the pleura. The bladder contained a reddish-brown coloured urine. The visible mucous membranes and skin were very pale, anæmic and tinged greenish yellow.

In the chronic cases the liver was intensely congested, the bile viscid and dark in colour. The kidneys, heart and lungs were congested and showed numerous small hæmorrhages on their surfaces.

The babesiæ were seen either in or outside the red blood corpuscles in stained blood smears during the making of the differential leucocytes count. They were either single, double, in fours or eights in the blood cells. Many evolution forms with circular, oval or irregular shapes were noticed outside the red cells. Inside the red cells the parasites exhibited a double pear-shaped appearance and were separated or united at their tapering ends. These forms reached about 3 to 4 microns long by 1.5 microns. As usual, a single homogeneous chromatin body (karyosome) and many other smaller chromatin granules were seen in the body, which was sometimes vacuolated.

The babesiæ were seen in blood smears in the febrile stage. The number of the infected corpuscles varied considerably. They were more abundant in the acute form, in which they were present in considerable numbers during

and immediately after the febrile period. In the chronic form the parasites were often scarce but, usually, repeated examinations made on successive days revealed their presence.

Results and Observations

Red Blood Corpuscles

In the acute case this count was at first within the normal range, amounting to 5,410,000 per c.mm. It was later decreased until it fell to 1,340,000 per c.mm. After giving a diet of raw liver to the dog the count was raised for some time and decreased gradually until the animal died. The average count was about 3,271,000 per c.mm.

In the chronic cases the maximum count was 7,100,000, falling to 4,100,000 per c.mm., the average amounting to 5,824,000 per c.mm.

Hæmoglobin

In the acute case the hæmoglobin percentage was 59, decreasing to 12; the blood was at this stage pale yellow and watery. The average percentage was 33.

In the chronic cases the percentage was higher than in the acute form; it decreased from 75 to 46.

Colour Index

In the acute case the index fluctuated between 0.32 and 0.60, with an average of 0.51. In the chronic cases the minimum index was 0.44 and the maximum was 0.64, with an average of 0.54.

Reticulocytes

These cells were absent, at first, in the acute case, but appeared later in the peripheral blood and amounted to 16 per cent, with an average of 4.5 per cent.

In the chronic cases the average was below normal; it amounted to 0.79 and ranged from 0 to 4 per cent.

In stained smears of both acute and chronic cases the red cells were seen to be mere rings and clear in the centre. Polychromasia, poikilocytosis and anisocytosis were the main characteristics of these cases. Nucleated red cells, normoblasts and macroblasts were also encountered.

Total Leucocyte Count

Leucopenia was recorded in the acute case; the leucocyte count decreased for some time and then increased before death. The range was between 3,200 to 10,600, with an average of 4,200 per c.mm.

Leucocytosis, ranging between 4,200 and 23,200 per c.mm., with an average of 13,857 per c.mm., was recorded in the chronic cases.

Differential Leucocyte Count

Neutrophiles

Relative neutrophilia was present in all cases. The range for the acute case was from 56 to 94.7 per cent, with an average of 83.5 per cent of the total leucocyte count. The range for the chronic cases was from 38.5 to 80 per cent, with an average of 75.7 per cent of the total leucocytes.

It is to be noted that in the acute case the count commenced with 66 per cent and increased gradually to 92.3 per cent on the day before death.

Eosinophiles

These were markedly decreased in all cases and were totally absent in the acute case before death. They ranged between 0 and 5 per cent, with an average of 1 per cent of the total leucocytes in the acute case and between 0.3 and 10.5 per cent, with an average of 3.3 per cent of the total leucocytes in the chronic cases.

Lymphocytes

These cells were reduced to 11.7 per cent and 10.6 per cent of the total leucocytes, with a range from 4 to 27 per cent and 2 to 40.5 per cent for the acute and chronic cases, respectively.

In the acute case the percentage was high at first, then it decreased to the minimum before death.

Monocytes

These cells were much reduced in the acute case and remained within the normal range in the chronic cases.

In the acute case they ranged between 0.3 and 12 per cent, with an average of 3.8 per cent.

In the chronic cases they ranged between 3 and 26 per cent, with an average of 10.5 per cent of the total leucocytes.

Schilling Index

A shift to the left was noticed in both acute and chronic cases. The myelocytes and young forms were increased to 1 and 4 per cent in the acute case and were 0 and 0.3 per cent in the chronic cases. The stabs were also increased to 30 per cent and 17.5 per cent, respectively. The segmented cells were reduced to 47.8 per cent and 57.8 of the total leucocytes, respectively.

Discussion

The observations and data recorded in this study are in close agreement with those mentioned by Burnett (1917) on canine piroplasmosis ("malignant jaundice in the dog"), who states that a severe progressive anæmia is the chief feature of the disease. From the time of the appearance of the first symptoms, the number of the red corpuscles decreases slowly and regularly, then at the time of the hæmoglobin crisis, falls suddenly to two millions and below (Nocard). The hæmoglobin decreased, according also to Burnett, parallel to the red corpuscles from 12-13 per cent, the normal to 6-4 per cent and 3.5 per cent. The greatest reduction found by Wright was from 110-18 per cent; the smallest amount of Hb, 17 per cent.

"The blood is pale as if diluted with water. Coagulation is slower than in normal blood. The serum is tinted with Hb. The red corpuscles present considerable changes, some are larger and paler than normal; some are smaller than normal. At the time parasites appeared, erythroblasts were also found present (Wright). Erythroblasts in some cases are present in large numbers.

XUM

" The leucocytes are usually much increased." (This differs from our data as we found leucopenia and this was confirmed upon a new case of piroplasmosis in the hospital of the school examined more recently, where total leucocyte count ranged between 1,000-3,000 per c.mm.)

" Nocard found as high as 40,000. Wright found nearly 52,000 in one and 60,000 in a second case. In one dog Wright found that the leucocytes dropped from 20,000 on the 15th day to 10,000 on the 22nd day. The increase, according to Nocard and Motas, is nearly always in the polymorphonuclears. In Wright's case both polymorphonuclears and mononuclears were increased.

" In the chronic form of the disease there is marked anæmia, the red corpuscles decreasing to about 2,000,000. In one of Nocard and Motas's cases they fell to 1,200,000; the return of normal is very slow. They are scarcely returned to normal before two or three months (Nocard and Motas). As recovery progresses the number of red corpuscles increases; erythroblasts become rare. The Hb suffers much less than the red cells. In one of Nocard and Motas's cases, with only 2,760,000 red corpuscles, there was 91.0 per cent Hb. The change in the size and staining of red corpuscles are more marked than the acute form. Some corpuscles are two or three times the normal diameter and they stain less deeply. Many erythroblasts are present at the beginning of the decrease in red corpuscles.

" The number of leucocytes is increased ordinarily from 15-30,000. Nocard and Motas record one case where they reached 54,000. The leucocytosis involves polynuclears and mononuclears equally."

A more complete discussion will be written upon this subject of the blood in canine babesiasis when further studies which are in progress are completed.

Summary

One acute case and two chronic cases of canine babesiasis were systematically examined during this study. In the acute case the blood became thin and pale and the number of the red blood corpuscles greatly reduced from 5,410,000 to 1,340,000 per c.mm. The hæmoglobin percentage was reduced from 59 to 12 per cent. The colour index was within normal range. The reticulocytes, as well as the erythroblasts, were very much increased. Polychromasia, poikilocytosis and anisocytosis were noticed in stained blood smears. The total leucocyte count per c.mm. decreased from 8,600 to 3,200 and then increased to 10,600 the day before death. In the differential leucocyte count neutrophilia was marked, with consequent reduction of the other varieties, especially the eosinophiles, which were totally absent before death. The Schilling index showed a moderate shift to the left in the neutrophiles.

In the chronic cases the changes were less pronounced. The red blood corpuscles decreased from 7,100,000 to 4,100,000 per c.mm. The hæmoglobin was reduced from 75 to 46 per cent. The reticulocytes were below normal, but erythroblasts were noticed in stained blood smears. Polychromasia, anisocytosis and poikilocytosis were constant features. The colour index was higher

XUM

than normal. The total leucocyte count was increased from 4,200 to 23,200 per c.mm. Marked neutrophilia with reduction in lymphocytes and eosinophiles was recorded. The monocytes remained within the normal range. The Schilling index showed a slight shift to the left in the neutrophiles.

(b) Hepatozoon Canis Infection

Some of the dogs studied, namely 21, were apparently normal, showing no symptoms except emaciation. They were heavily infested with ticks and lice. Careful post-mortem examination revealed no abnormalities except connective tissue tumours in the œsophagus containing *Spirocerca sanguinolenta*. Intestinal parasites were infesting all cases.

On performing the differential leucocyte count from stained blood smears, oval, elongated, sky-blue coloured bodies were observed in the polymorphonuclear cells.

On investigation, these bodies were diagnosed as *Hepatozoon canis*, a species belonging to a genus of the family hepatozoidæ of the sub-order hæmogregarinidæ.

Wenyon (1926) states that this parasite, which was discovered by Bentley (1905) in India, is very similar to *H. muris* of the rat. It occurs in the leucocytes of dogs in various parts of the world, and he alludes to work by the following authors.

James (1905) observed it in India and gave the name *Leucocytozoon canis* to the parasite. It was discovered by Gerrard (1906) in Malaya, by Christophers (1906) in Madras, by Mthis and Léger (1909) in Tonkin, by Lebœuf and Ringenbach (1910) in the Congo, by Kleine (1910) near Tanganyika, by Yakimoff and Kohl-Yakimoff (1911) in Tunis, by Basile (1918) in Senegal, and by Wenyon (1911) in Baghdad.

From the work of Christophers (1907) and of Wenyon (1911) it appears that the schizogony cycle of *Hepatozoon canis* takes place in the spleen and bone marrow.

Rau (1925) has seen schizonts in the liver also. The gametocytes which occurred in the leucocytes undergo development in the common dog tick, *Rhipicephalus sanguineus*. Infection of the dog is probably produced by the ticks being eaten. The small merozoites are undoubtedly the forms which enter the leucocytes, while the large ones are probably destined to become schizonts again. If the spleen pulp of an infected dog is broken up in saline solution and the emulsion examined in wet preparations, these schizonts or groups of merozoites are seen enclosed in a definite cyst. The wall appears to be of the thickness of a cyst of *Entamœba coli*. Rau claims to have infected dogs by injection of spleen material containing schizonts as also by the injection of the tissues of infected ticks. Parasites appear in the blood of dogs in two or three weeks after inoculation, and it is stated that the infection progresses in intensity and may bring about the death of the animal. It is by no means clear from this account that other causes of death were excluded.

Results and Observations

Red Blood Corpuscles

The red cell count was below the average normal; it ranged between 3,300,000 and 6,250,000, with an average of 4,940,000 cells per c.mm.

Hæmoglobin Percentage

The hæmoglobin percentage was also below the normal average; it ranged from 40 to 75 per cent, with an average of 55 per cent.

Colour Index

This was above the normal level, ranging from 0.40 to 0.69, with an average of 0.56.

Reticulocytes

These were within normal range, amounting to 1.3 per cent.

Total Leucocyte Count

There was no significant change in the leucocyte count; it ranged between 7,200 and 20,000, with an average of 12,400 c.mm.

Differential Count

The neutrophile cells were slightly reduced. They ranged between 48 and 82 per cent, the average being 64.8 per cent.

The eosinophiles were very much increased, averaging 11.7 per cent; they ranged from 0.3 to 22.8 per cent.

The basophiles were totally absent in all cases.

The lymphocytes were decreased, the range being from 5-29 per cent, with an average of 15.9 per cent.

The monocytes were reduced to 7.6, with 2.6 and 18 per cent as minimum and maximum limits.

Schilling Index

The myelocytes and juvenile cells were increased to 0.5 and 1 per cent of the total leucocytes, respectively. The stab cells were also increased to 9.8 per cent of the total leucocytes, while the segmented cells were decreased to 53.8 per cent of the leucocytes.

Summary

Of the dogs studied, 21 were found to contain *Hepatozoon canis* in their polymorphonuclear leucocytes. These were elongated, oval, sky-blue coloured bodies with rounded ends, each parasite containing a nucleus which was situated centrally or near to one of the ends. The hepatozoon measured 9 to 10 microns in its longest diameter by 4.5 to 5.5 microns in breadth. Round or pear-shaped forms as well as extra-cellular forms were also seen. Intra-cellular parasites were either situated upon the nucleus which could be seen or inside the cytoplasm pushing the nucleus to one side of the cell.

The affected cells are usually of the segmented polymorphonuclear leucocytes. They are enlarged, degenerated or totally broken down. In diameter the affected cells reached up to 15 microns. The nuclei were paler than those of the unaffected cells and took the stain very faintly. The proportion of infected to non-infected leucocytes varied from 12 to 15 per thousand.

XUM

The blood picture was that of a secondary anæmia, with a low red cell count and hæmoglobin percentage and a high colour index.

There was a neutropenia with a marked eosinophilia. There was also a reduction in the percentage of lymphocytes and monocytes.

Young and stab forms of the neutrophiles were increased, while the segmented cells were decreased. Schilling index showed a deviation to the left in the neutrophiles.

Hepatozoon canis is now recorded here for the first time in the blood of dogs in Egypt.

REFERENCES

Burnett, S. H. (1917): The Clinical Pathology of the Blood of Domesticated Animals. The Macmillan Company, New York. 2nd Ed., p. 127.

Wenyon, C. M. (1906): Protozoology. Baillière, Tindall and Cox, London. Vol. 2, p. 1091.

JOHNE'S DISEASE: A Preliminary Note upon the Prevention and Control of the Disease

By K. D. DOWNHAM

In giving my experience of this disease I should like to record that in 1927, when I was Veterinary Adviser to the University of Liverpool, the owners of one of the largest and best herds of dairy cattle in the North had experienced such severe losses from the disease that they were almost ready to give up their herd. They approached me and stated that they were prepared to go to considerable expense in an endeavour to control Johne's disease and to find out more about the cause and prevention of the disease for the sake of the dairy farmers generally as well as in their own interests.

Nearly 100 post-mortem examinations were made upon cattle of all ages. Many avian, mammalian and bovine tuberculin tests were carried out, and an intradermal test with a preparation made from *M. phlei* and *M. johnei* was used on animals in this herd. After over three years' work the results indicated that some other factor or factors were of importance, in addition to that of infection by the causal organism, *M. johnei.* It was decided to try the effect of improved methods of hygiene and to concentrate upon a positive health policy by eliminating other causes which appeared to have influenced the disease on this low-lying West Lancashire farm.

A high-ground rearing farm was purchased, and all the young stock was reared there.

Greatly improved methods of husbandry were practised on the original farm. These included the practice of ploughing up the old pastures and following a seven-year rotation, which enabled young stock to use new pasture leys which had not been used for three years previously either by cattle or sheep.

This method of treating the land and the institution of good positive health practices of feeding and management proved highly successful.

It is now over twenty years since this experiment was conducted, and the owner informed me recently that they had not had a single case of Johne's since.

One cannot help being impressed by results of this kind.

For many years when carrying out investigations upon prevention of Johne's disease, of infertility, of parasitic and nutritional diseases caused by wrong stock-raising and feeding practices, one has been able to see the excellent results which it is possible to obtain by establishing positive health in many herds and flocks among which it has been my privilege to work, and to gain the confidence of many of the leading stock producers from results which have been obtained.

As a profession have we not been concentrating too much upon types and strains of organisms, vaccines and sera, and too little upon building up really healthy animals, which are able to meet and overcome a reasonable degree of infection because of their natural resistance, which is acquired under sound animal husbandry practices?

In 1948, when conducting investigations at Boots' Research Station, Thurgarton, Notts, a local farmer—who had lost fourteen animals with Johne's disease in just over a year—gave me an animal which was in the last stages of the disease, for research purposes. This animal was practically dying on arrival and could be compared to Fig. 1, which shows a Guernsey cow in an advanced stage of the disease. For over six months at intervals of seven to ten days I gave this cow blood transfusions from other healthy pregnant cattle, and also provided her with a good diet containing the essential amino-acids, vitamins and minerals. Although for some time the cow was so weak that she could not get to her feet without the aid of slings, after some months of treatment she became perfectly healthy in appearance, with a good bloom on her coat, and passed fæces of normal consistency.

Fig. 2 shows an animal which was suffering from diarrhœa and was in poor condition. The owners had not been able to get the animal in calf. When first seen her fæces were positive to the microscopical test for Johne's disease, and her blood positive to the complement fixation test for the disease. She was brought to the Ministry of Agriculture's Veterinary Laboratories, Weybridge, kept in a loose box, and given a good diet with a mineral mixture containing 60 per cent sterilised bone flour and minor elements in suspension in her drinking-water, other water being withheld. This treatment was continued for four months, after which the animal had greatly improved in condition, the diarrhœa had ceased, and on daily examination of her fæces for a week no Johne's disease organisms were found. The animal was turned out to grass, served by artificial insemination, became pregnant, calved a normal calf, and has remained healthy to date.

Since the autumn of 1948 I have been privileged to conduct a survey upon Johne's disease for the Agricultural Research Council and have been investigating the extent to which the disease occurs in some herds in this country. Some interesting data have been collected from a study of nearly 100 herds

FIG. I.

FIG. II.

(Article by Downham, page 309)

Microfilaria in the blood stream of a dog. Believed to be *A. dracunculoides*.

(Article by Piercy, page 311)

XUM

where the disease has been serious. The new owner of a herd in Hampshire with the worst record for Johne's disease (i.e., forty-six animals dead in the previous four years) co-operated fully with regard to feeding, management and hygiene, and no animal was removed from the herd for over eighteen months because of Johne's disease; after which one animal was slaughtered, the others remaining healthy until the herd was dispersed.

Several animals have been found to pass Johne's disease organisms in their fæces and have been treated successfully by removing serious contributing causes such as (*a*) early pregnancy and high milk production upon a diet short of essential proteins, minerals or vitamins; (*b*) prevention of parasitic infestation of young animals; and (*c*) most important of all—instituting good methods of calf rearing and raising of sound healthy stock.

Recently it has been possible to infect a calf of under three months of age which had been reared badly and to produce diarrhœa with typical lesions of Johne's disease in the intestines: whereas several calves which were reared well and were the same age or younger failed to become infected with Johne's disease after receiving very much larger doses of infected material by mouth.

From these experiences it appears evident that Johne's disease is largely a disease of faulty dairy farm practices, and can be successfully controlled by instituting sound preventive methods of hygiene, nutrition and husbandry.

It is hoped to give a full account in a future publication of the methods of controlling Johne's disease which have proved successful.

I should like to record the pleasure I have experienced in working with the Ministry of Agriculture's Veterinary Staff. My thanks are particularly due to Sir Thomas Dalling, C.V.O., Ministry of Agriculture, and to Dr. Stableforth, Director of the Veterinary Laboratories, Weybridge, to Mr. Hole, Head of the Pathology Department, to Dr. E. L. Taylor, and last but by no means least to Mr. T. M. Doyle, Senior Research Officer, with whom it has been delightful to work.

A NOTE ON CANINE FILARIASIS

By S. E. PIERCY,

Senior Veterinary Research Officer, Veterinary Research Laboratories, Kabete.

On July 1, 1948, a ten-month-old, cross-bred Alsatian dog, weighing 75 lb., was presented for examination with a history of progressive loss of condition. Apart from the fact that the animal was thin, there was little evidence of ill-health, and premonitory signs of specific infectious disease were absent. A provisional diagnosis of hookworm was made. By July 26, when the dog was seen again, marasmus was pronounced, and the owner reported that exercise was followed by exhaustion. A specimen of stool was examined for the presence of helminth infection, with negative results. There was still no evidence of the presence of infectious disease, such as tick fever or Rickettsia, and there was no

visible evidence of anæmia. In the absence of a positive diagnosis, 16 grains of stovarsol and 8 grams of sulphapyridine per day were prescribed, and treatment for tapeworm was administered.

A week later the dog was found to be weak and listless, the appetite was capricious, the pulse was rapid and "bounding," the temperature was 104° C., there was slight opacity of the conjunctiva of the right eye, and some œdema of the extremities. After a prolonged examination of a blood smear, one microfilaria was found (plate). There was still no anæmia. Two c.c. of blood was then collected, at night-time, into citrate solution, lysed with an equal volume of water, centrifuged at 1,500 r.p.m. for 5 minutes, the supernatant fluid discarded, and a smear made from the cellular deposit. After staining for 30 minutes with Giemsa diluted 1 : 10, the smear was examined, and seven microfilariæ identified.

Treatment consisted of a course of five subcutaneous inoculations of 5.0 c.c. of a 12 per cent solution of stibophen (sodium antimony bis-catechol-3 : 5-disulphonate), every four days. In addition, Tr. belladonna, 20 minims twice a day, was prescribed.

On August 7, two days after treatment with stibophen was commenced, the right eye had become completely opaque, although there appeared to be a slight improvement in the dog's general condition. A week later a marked improvement was noticed, the conjunctival opacity was less pronounced, and there was an appreciable gain in body-weight. Thereafter favourable progress continued, all clinical symptoms gradually disappeared, and eventually recovery became complete. No relapse has occurred to date.

Discussion

Until recent years, references to the treatment of canine filariasis were comparatively scarce, and characterised by a variation of opinion as to the best drug to be used. Underwood and Wright (1934) recommended the use of fouadin (a trivalent antimony compound). Carmichael and Bell (1943) failed to note any improvement in a case of filarial dermatosis using a 5 per cent solution of antimosan, given in a dosage of 3.0 c.c. on five occasions at two-day intervals. These authors also noted that their treatment failed to eliminate microfilariæ from the blood stream. Purchase (1950) and Ziegler (1950) record the successful treatment of cases of *D. immitis* with piperazine compounds ("Hetrazan" and "Caricide"). Extensive investigations into the chemotherapy of filariasis have recently been made by Otto and Maren (1950), who conclude that arsenamide for the adult worm and "Hetrazan" for the microfilariæ of *D. immitis* are the drugs of choice.

Experience with stibophen in this Colony has been mainly confined to the treatment of trypanosomiasis. The tablets contain 13.5 per cent of trivalent antimony, and the recommended dosage for dogs weighing over 35 lb. is 2.0 c.c. daily of a 6.3 per cent solution for a week, followed by daily doses of 2.5 c.c. for a further 14 days. It will be noted that the dosage adopted in the case under

discussion followed a different pattern. This was due to the fact that it was not possible to administer daily injections. In consequence, both the dosage and the strength of the solution used were doubled and the interval between inoculations considerably lengthened.

Two points of interest emerge. Firstly, that treatment with stibophen was completely successful, and, secondly, that a cure was achieved by the administration of larger doses at longer intervals than recommended, a point of practical importance in countries where distances between client and veterinarian may be considerable.

In Kenya, it is considered that the species of filaria parasite pathogenic for dogs is *Acanthocheilonema dracunculoides,* the adult forms of which occur in the peritoneal cavity. In other countries, the common filarial parasite is the better-known *Dirofilaria immitis,* but this species has not yet been found in this Colony. Carmichael and Bell (1943) consider that it does not occur in Africa, and both Mönnig (1947) and Hutyra, Marek and Manninger (1949) exclude it from their lists of African filariæ parasitic for the dog. The single case of *Dirofilaria immitis* recorded by Purchase (1950) occurred in a dog imported from Fiji, and it is unlikely that infection was contracted in Kenya.

Very careful measurements of the larvæ in the present case were made according to the system advocated by Fülleborn (quoted by Mönnig), whereby the distance of certain fixed points in the larval body from the anterior extremity are expressed as percentages of the total length. These are given in the table below, along with those quoted by Mönnig for *D. immitis* and *A. dracunculoides.*

Microfilariæ measurements. Distances of fixed points from the anterior expressed (a) as percentages of the total length and (b) in microns.

Species	N	Ex. P	Ex. Z	G^1	A.P.	L.S.Z.	Total length
M. immitis, per cent ...	21.4	29.3	35.0	61.9	74.8	90.0	218-329μ
M. dracunculoides (Piercy), per cent	21.0	27.3	36.0	59.3	73.0	83.0	194μ
M. dracunculoides (Mönnig), percentages deduced ...	21.2	32.0	—	—	74.5	90.5	212μ (average)
M. dracunculoides (Piercy), microns	41.5	53.0	70.0	115.0	141.0	161.0	194μ
					53.0*	33.0*	
M. dracunculoides (Mönnig), microns	45.0	66-70	—	—	53-55*	20.0*	195-230μ

* Distance from posterior extremity.

Note.—N = nerve ring. Ex. P = excretory pore. Ex. Z = excretory cell. G^1 = first genital cell. A.P. = anal pore. L.S.Z. = last tail cell.

It will be observed that the microfilariæ in the present case were very much shorter than *D. immitis,* although similar in other respects. Purely as regards total length, they were characteristic of the measurement given for *A. dracunculoides.* Such figures as are given by Mönnig for the latter parasite are incomplete and expressed in microns. When the measurements of the larvæ under review are similarly expressed, it is seen that, apart from total length, there are certain discrepancies. Reference to available standard works failed to reveal alternative measurements for *A. dracunculoides.* The figures given here, therefore, may be of interest to workers in the field of systemic helminthology.

Summary

1. A case of canine filariasis believed to be due to *Acanthocheilonema dracunculoides* is described.
2. A cure was obtained using stibophen (trivalent antimony).
3. Measurements of the microfilariæ studied are recorded.

Acknowledgment

My thanks are due to the Director of Veterinary Services, Kenya, for permission to publish this article.

REFERENCES

Carmichael, J., and Bell, F. R. (1943): *J.S.A.V.M.A.,* XIV, 3.
Hutyra, F., Marek, J., and Manninger, R. (1949): "Special Pathology and Therapeutics of the Diseases of Domestic Animals." Vol. III. London: Baillière, Tindall and Cox.
Mönnig, H. O. (1947): "Veterinary Helminthology and Entomology." 3rd Edit. London: Baillière, Tindall and Cox.
Otto, G. F., and Maren, T. H. (1950): *Am. J. Hyg.,* 51, No. 3, May.
Purchase, H. S. (1950): *Vet. Rec.,* LXII, 3.
Underwood, P. C., and Wright, W. H. (1934): *Vet. Med.* XXIX (6), p. 234.
Ziegler, C. G. (1950): *J.A.V.M.A.,* CXVI, No. 876, March.

REVIEWS

INDEX OF TREATMENT, by Hamilton Kirk, M.R.C.V.S. Second Edition. Pp. x + 826, with 177 Figs. London: Baillière, Tindall & Cox. Price 40s.

THIS is the second edition of a book which was published for the first time in June, 1948. If the value of a book can be measured by the demand, then there can be no doubt that this one ranks high.

There is evidence of considerable revision in the text and of new material. The section dealing with hormone therapy is now more comprehensive, and incorporates a classified list of those endocrine products which are distributed under proprietary names. This is a very useful addition. The part devoted to recent advances in the methods of bone repair is done quite well and should prove valuable to those practitioners who have not access to all current literature.

In view of the new discoveries which are disclosed almost every day, it would be difficult for any author to write a completely up-to-date account of

modern chemotherapy. It would be impossible even if the author was a specialist in that particular line, and if the pages were devoted entirely to the subject, on account of the lapse of time between MSS. and publication. The section on chemotherapy in this book is succinct and the fundamental information displayed therein will equip the reader well for any future development.

The section on euthanasia is an excellent idea. No part of a practitioner's work gives rise to more heart-burning.

The time has gone when it was the recognised custom to hand a beloved pet to the executioner. Public opinion demands, and rightly so, that the last moments shall be gentle and peaceful. We give an especial welcome to this section.

This is a difficult book to review, for it touches on many themes and it is of an encyclopædiaic nature. It can be said with truth that the author has accomplished, and with great success, a task which many would have deemed impossible. A glance at the length of the index, at the long columns of references, and even at the posological table will give some idea of the magnitude of the task. The publishers have done a good job, the illustrations are produced excellently, it is a mine of information culled from many sources, and the format is such as to make easy reference to any particular point.

The book will be appreciated by veterinary surgeons and students.

Finally, a word to the author. It is dangerous to claim that any work is completely up to date. The tempo of modern research is such that the time-lag between MSS. and final issue makes such a claim hazardous.

FERTILITY FARMING, by Newman Turner. London: Faber & Faber. Price 16s.

THIS is a remarkable book, and its author must be a remarkable man. An unorthodox enthusiast he may be, but it is impossible not to become infected by his enthusiasm and to push on from chapter to chapter. While primarily dealing with the successful management of a farm, there is much in this book to interest the veterinary surgeon, a special section of six chapters being devoted to "Animal Diseases, their Prevention and Treatment by Natural Methods and with the Aid of Herbs." That may sound nothing but the completest form of quackery, but when a man says he can, and has, bought cows with T.B. and other diseases, and has cured them and bred from them, his views and methods merit more than cursory examination. The description of a plate of a prize-winning bull reads: "Longmoor Mogullas Top Sergente. At 4 years old rejected by Ministry of Agriculture on account of T.B. Treated for nine months by Newman Turner and returned to herd. Now 10 years old and has never shown a sign of reaction or other ill-health since he returned to the herd. He has never been without a prize at many shows in all parts of the south-west, even in his ninth year."

The whole design and intention of this book is to describe the author's methods of farming and handling livestock without the use of chemical fertilisers and to demonstrate that these methods are sound, practical and economic.

XUM

We commend it to the attention of every veterinary surgeon, for it is stimulating to read and of absorbing interest, whether or not its "truths" can be swallowed in whole or in part. It would, none the less, not be too much to say that the future of mankind depends largely on the proof or disproof of much of what is said in this book.

NEWS

UNDER the auspices of the Veterinary Society of Zootechnics of Spain, the Second International Veterinary Congress of Zootechnics will be held in Madrid on October 21 to 28, 1951.

The Congress will be divided into two principal sections: General and Communications. The former will, however, deal with the problems relating to: (i) dairying and agriculture; (ii) production of wool, meat and animal fats; and (iii) animal reproduction and artificial insemination of domesticated animals. Besides these, there will be a discussion on the importance of the Zootechnics on the present-day veterinary science. Communications will be read by the members of the following branches of the veterinary science: Cytology, Genetics, Ecology, Phylogeny and Taxonomy, Biometry, Biogeography, Bio-climatology, Animal Reproduction, Artificial Insemination, Animal Nutrition, Physiology and Sex-endocrinology, Criteria for judging the morphological, physiological or genetic value of the individual, Livestock economy.

The Congress will examine, amongst other things, the possibility of creating a Veterinary Society of Zootechnics in every country and also of the foundation of an International Federation of Veterinary Societies of Zootechnics.

The official languages of the Congress will be English, French, German, Italian, Portuguese and Spanish.

The fee for a foreign member is five dollars or equivalent sum in the currency of their own respective country.

All correspondence and communications should be addressed to: Prof. Dr. Carlos Luis de Cuenca, Faculdad de Veterinaria, Embajadores, 70, Apartado 1200, Madrid, Spain.

G.

Publishers' Notices

THE BRITISH VETERINARY JOURNAL, with which is incorporated THE VETERINARY JOURNAL, is published monthly, and copy for advertisements should be in the hands of the advertisement manager not later than the 20th of the preceeding month, if proof is required. Tel.: Temple Bar 3386.

Letters for the Journal, literary contributions, reports, notices, books for review, exchanges, new instruments or materials, and all matter for publication (except advertisements) should be addressed to the Editor.

Annual Subscription, 40s. ($6.50 U.S.A. currency, post free.)

XUM